acidity and has a high calcium requirement for quality lint production. Liming neutralizes soil acidity, supplies the calcium and magnesium required for plant growth and fiber production, and promotes the efficient use of other plant nutrients.

Rate and timing of nitrogen applications strongly influence cotton yield. Low nitrogen reduces yield. Too much causes excessive vegetative growth, makes pesticide coverage more difficult, delays fruiting and maturity, increases attractiveness to insects and reduces the effectiveness of defoliants.

The nitrogen rate of 50–70 lb per acre given on the soil test report can be adjusted depending on soil type and expected yield potential. See section **Realistic Yield Expectation (RYE) N Rates**.

On sandy coastal plain soils where nitrogen is subject to leaching, apply 20–25 lb per acre at planting with the remainder side-dressed shortly after formation of squares. On deeper sandy soils where leaching is extensive, apply side-dressed nitrogen in split applications. Apply all nitrogen by mid-June.

In most cases, apply all recommended P_2O_5 and K_2O at planting. High-phosphate starter fertilizer (10-34-0), banded at planting, can enhance growth and maturity for cotton planted early on cool soils. Place banded starter fertilizer 2 inches to the side and 2 inches below the seed to avoid salt injury to young seedlings. On deep, sandy-textured soils where potassium leaches, consider split applications of K_2O.

Table 1. Average plant nutrients available the first year after broadcast application of animal waste *

	N	P_2O_5	K_2O
	-------- *lb/ton* --------		
Broiler house litter (> 6,000 samples)	29.0	26.8	40.0
Turkey house litter (> 2,500 samples)	24.2	28.0	26.6
	---- *lb/1000 gallons* ----		
Anaerobic swine lagoon (> 38,000 samples)	1.8	1.0	5.4
Dairy manure slurry (> 1,500 samples)	4.6	4.2	9.7

* Based on NCDA&CS waste analyses, 1999–2006.

Boron is essential for good bloom set, seed development, and fiber production. The boron recommended on a soil test report (1.0 lb per acre) is for broadcast application during seedbed preparation. Alternatively, if borated fertilizer is banded, apply 0.2–0.4 lb actual B per acre. For foliar application, use 0.25 lb B per acre at early bloom followed by another 0.25 lb after two weeks. Select a highly water-soluble boron source. Monitor the boron status during the season with plant tissue analysis.

Sulfur deficiency can occur on sandy coastal plain soils where the clay is below 16 inches, particularly in seasons of excessive rainfall. Rates of 20–25 lb per acre applied along with the fertilizer safeguard against sulfur deficiency under most soil and climatic conditions. Since sulfur and nitrogen deficiencies are similar, submit plant tissue and soil samples for problem analysis and verification.

The soil test report gives a sulfur recommendation whenever S-I $\leq$ 25. Since sulfur leaches readily, it may be adequate at the time of the report but be limiting later during the season. To monitor sulfur levels during the growing season, take plant tissue samples and send them to the NCDA&CS lab for analysis.

Realistic Yield Expectation (RYE) N Rates

More specific nitrogen rates can be used based on realistic yield expectations by soil type. These rates are required for waste and nutrient management plans in some N.C. river basins. Rates using the RYE approach are available online at www.soil.ncsu.edu/nmp/yields/.

Livestock and Poultry Manures

Farm manures can be valuable sources of N, P_2O_5, K_2O (Table 1) and, in some cases, the micronutrients zinc and copper. Since nutrient content varies with rate and method of application, it is best to have the manures analyzed for nutrient content near the time of application. NCDA&CS offers a basic waste analysis for a fee of $5.00 per sample and special tests (lime equivalence, heavy metals, nitrogen breakout) for an additional fee of $10 per test per sample.

Repeated applications of animal waste can lead to high levels of zinc and copper within crops. Excessive levels can be toxic to plants and cause reproduction problems in livestock. Test soils regularly to determine when to discontinue application of manures for a particular site.

North Carolina Department of Agriculture and Consumer Services

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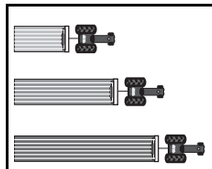

NOTE 3: Fertilization of Field Crops

Lime Sources

Liming is the application of calcium or calcium-magnesium compounds that are capable of neutralizing soil acidity (raising the soil pH). Two major types of lime are used for agricultural purposes: calcitic and dolomitic. Calcitic limestone is composed of calcium carbonate ($CaCO_3$) and contains little or no magnesium. Dolomitic limestone is a mixture of calcium and magnesium carbonates [$CaMg(CO_3)_2$] and contains, by state law, 6 percent or more magnesium. Most lime sold in North Carolina is dolomitic lime. Agricultural grade lime, or ag lime, must meet specifications in fineness of grind and guarantee a neutralizing value established by state law.

Lime Rates

The rate (tons per acre) of lime recommended on the soil test report should raise the pH to

- 5.0 for organic (ORG) soils,
- 5.5 for mineral organic (M-O) soils and
- 6.0 to 6.2 for mineral (MIN) soils, depending on the crop to be grown.

The recommended rate varies depending on the level of soil acidity and the target pH for each soil type. The pH obtained with a given rate of lime varies depending on uniformity of application, particle size, neutralizing value, method and depth of incorporation, and soil texture.

When lime is recommended, apply it as early as possible to allow enough time to neutralize soil acidity. For best results, use a high-quality ag lime and incorporate it thoroughly into the top 8 inches of soil. Apply and incorporate lime prior to beginning reduced or no-till systems if possible. Maintenance applications can be surface applied.

A low soil pH is associated with low levels of calcium and/or magnesium as well as high soil acidity. As the level of soil acidity increases, aluminum increases and becomes toxic to plants. The efficiency of nutrient uptake and use decreases as well.